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tion with the historic theoretical solutions of the problem; and in the third part, to propound his own theory of the will and indicate the relations of the topic to science and philosophy in general. For various reasons he abandoned this design and decided to publish the present contribution, containing an outline of his own theoretical views. The work reveals this origin in a disjointedness of some of its portions that makes it difficult to read and still more so to résumé.

In the introduction he explains that it is not his object to enter into metaphysical considerations, but to attempt to bring into harmony the various physiological and psychological facts of voluntary action. This he does under three heads. The first section treats of the "voluntary action as a motor process," and carries out with great suggestiveness the view that all action is at bottom of the type of a simple reflex act of greater or less complexity. The difference in complexity is of course enormous, especially so when the reaction follows only after a long interval and indirectly, but the fact that all acts find a place in the scale that begins in the simplest contraction is to him the important one. Closely connected with this point is the prominence of the evolutionary doctrine throughout his treatise. A sensori-motor mechanism is the result of an adaptation to the environment by evolution; the less completely adapted mechanisms failing to survive. This conception of all action as a useful reaction upon the stimulus furnished by the environment is carried all the way up, even to acts where the social factor is uppermost, where action becomes conduct, and forms one of the most interesting portions of the work. "The voluntary action as a phenomenon of consciousness" is the title of the second section of the work. It consists in the main of an analysis of the factors in a voluntary act, bringing to the front the "innervation feeling." This feeling is the important point, and when it is anticipatory the act that arouses it becomes voluntary. An act cannot be voluntary the first time it is performed; to learn how to perform a new combination of movements we must get the feeling of the accomplished result. The third section ("the voluntary action as a conscious motion") considers the various theories of voluntary motion, especially such as are based upon physiological experimentation, and criticises their weaknesses. His own interpretation of the voluntary process is founded upon the sensori-motor nature of all action. No brain-centre can be motor alone or sensory alone, but both at once. The various parts of the brain serve the purposes of various kinds of sensori-motor reactions, differing not only in complexity, but in the nature of their associations.

Dr. Münsterberg's treatment of the will coincides in many points with that recently sketched in an essay by Prof. William James, and it is important not only as a convenient compend of an interesting theoretical chapter of physiological psychology, but also because it suggests leading lines of thought by which the results of experimentation are to be interpreted.

J. J.

*Ueber das Geruchsvermögen der Krebse.* Inaug. Dis. K. MAY. Kiel, 1887.

This is a painstaking attempt to determine the anatomy of the olfactory "hairs" of the crab, the chemical composition of their viscus content, and their physiology, by a pupil of Professor Hensen, whose work on auditory hairs has been so fruitful. His conclusions are that the neural content of these hairs near the end of the anten-

nula reacts, by either molecular change or transposition, to odors, and that the disturbance is carried to the centre by nerve fibrils emerging from these hairs. The sum of the surface of these hairs and the number of nerve elements is very large for the size of the animal. However multifarious the olfactory sensations of the crab, one smell, viz. that of decaying fish, is perceived at great distance in darkness. The nerve fibres which go to each hair, and which end in the ganglion, are seen to divide into many fibrillæ. Each hair is a perceptive element. The simple stimulus affecting each hair is met by many fibrillar sensory elements. Thus on the principle of specific energy olfactory sensation cannot be simple, but composed of mixtures of a number of fundamental sensations. Possibly elemental odors corresponding to each species of olfactory fibre may some time be made out by experiment and analysis. Unities of the first order, Professor Hensen appends, may be the designation of the 40 to 100 hairs, and which might be characterized by their order on the antennula. The single fibrillæ and ganglion cells—about twenty to each hair—may be called unities of the second order. With these latter we must start, assuming that their functions are at least not identical, or else the arrangement would be like that of auditory hairs of crabs, to each of which but one hair and one ganglion cell belong. The three or four fibrils each of tactile hairs give one for the bending of the hair in each direction, while by olfactory hairs the specialization of function represents differences of chemical action. Further, as some fibrils are more central than others, not only quantitative but qualitative differences might arise as odorous substances acted penetratingly or superficially upon the content of the hairs. Different hairs, too, may not only control each other and intensify effects, but, as their nutrition and composition may be different, may afford basis for further differentiation of perceptive analysis. Thus Hensen's theory of assimilating and dissimilating processes does not necessarily apply here.

*Ueber die Veränderung der Tastempfindung durch Heilmittel.* Inaug. Diss. L. ISRAEL. Würzburg, 1887.

Caustic lime, nitric acid, chlorate of zinc, sulphuric acid, iodine, chlorine, bromine, phenol, mustard, cantharides, croton oil, ether, alcohol, chloroform, morphine, carbolic acid, strychnine, ergot, arsenic, nitrate of amyl, oxalic acid, several aniline dyes, aconite, quinine, and other substances in fit solutions were applied to the skin and the resulting sensations noted, and the sensibility in discriminating compass points tested before and after the application. The results cannot be briefly stated, but the work is suggestive. Far more extended studies with each substance are needed to give results of great value. The entire paper occupies but about forty pages, and serves only to suggest further and more detailed work in the same direction, which seems very inviting and very promising both practically and scientifically.

*Die Beeinflussung unserer Hauttemperatur durch Amylnitrit.* Inaug. Diss. F. LAHNSTEIN. Würzburg.

The inhalation of fumes of nitrate of amyl was found, when measured on a thermoscopic-galvanometric apparatus, to cause an increase of over three degrees C. in the superficial temperature of